CLAIMS

1. A method for manufacturing low PMD single-mode fiber comprising the steps of:

fixing a preform to a preform feeding mechanism at the top of a fiber-drawing tower;

sending said preform into a fiber-drawing heating furnace and performing the fiber-drawing process therein;

making the drawn fiber to pass through bare fiber geometrical dimension monitor, coating system, twisting system, fiber-drawing tension wheel, finished optical fiber geometrical dimension monitor system, and take-up system successively, wherein

said fiber is forced to spin round its axis under the action of the torque introduced by said twisting system; the spin direction of said fiber is changed periodically along with the back and forth swing of twisting wheel in a plane that is parallel to said fiber, and a special mechanical wave is formed; said mechanical wave propagates along the fiber towards the upstream fiber-drawing direction and attains the softened region of a preform in said fiber-drawing furnace; said mechanical wave causes a plastic deformation of the glass material in said softened region, and said deformation is set up in the newly drawn fiber;

a pair of twisting wheels of said twisting system apply their action on said fiber, the swing direction and the axial slope angle to the fiber of the plane in which the two twisting wheels are located and the axis of said fiber are always in axial symmetrical state, and said two twisting wheels always apply a given compressive stress on said fiber; and

the driving force introduced by said twisting system indirectly exerts to the fiber, and the driving force for twisting fiber originates from the friction between said fiber moving in the fiber-drawing direction and said twisting wheels.

2. The method of manufacturing low PMD single-mode fiber according to Claim 1, wherein the magnitude of said compressive stress is typically 0.5~5N, so that a good friction between said fiber and said twisting wheels is ensured.

3. The method of manufacturing low PMD single-mode fiber according to Claim 1, wherein the twist of the fiber is realized through the following manner: when there is a slope angle between the plane in which said twisting wheels are located and the fiber-drawing direction, the moving fiber brings along said twisting wheels to rotate round their axes respectively through friction, the fiber radial component of the angular velocity for the rotation of said twisting wheels applies reaction on said fiber through friction, and the twist of the fiber is produced.

4. The method of manufacturing low PMD single-mode fiber according to Claim 1, wherein the typical mean value of the turns per meter of said twisted fiber ranges from 25 to 100 turns/m, and the typical PMD coefficient of said fiber is not greater than 0.03 $ps/km^{1/2}$.

5. The method of manufacturing low PMD single-mode fiber according to Claim 1, wherein the distribution waveform of the twisted fiber in the length direction thereof is realized in different forms to combine periodically the components of constant amplitude and constant frequency with the components of variable amplitudes and variable frequencies, the typical twist waveform includes the following three forms:

a. said twist waveform does not include constant amplitude components and constant frequency components and non-twisted component in a period;

b. said twist waveform includes constant amplitude components and constant frequency components and non-twisted component in a period; and

c. said twist wave form includes constant amplitude components and constant frequency components, but does not include non-twisted component in a period.

6. The method of manufacturing low PMD single-mode fiber according to Claim 1, wherein said twisting system has a pair of positioning wheels, the plane in which said positioning wheels are located and the plane in which the moving twisting

wheels are located are always perpendicular each other, the outer surface of said positioning wheels do not apply compressive stress on the fiber.

7. The method of manufacturing low PMD single-mode fiber according to Claim 3, wherein a hard alloy having high polish precision may be selected as the material of said twisting wheels or said positioning wheels of said twisting system that contact with said fiber directly, the value of the surface roughness thereof is 3 microns, ceramic material, hard rubber material or plastic material may also be selected.

8. The method of manufacturing low PMD single-mode fiber according to Claim 1, wherein the motion formed by said twisting wheel has three forms: a pair of twisting wheels are stable in their vertical positions simultaneously; a pair of axes of twisting wheels are stable in their maximum slope angle positions symmetrically; and a pair of axes of said twisting wheels swing symmetrically between their vertical positions and maximum slope angle positions.

9. The method of manufacturing low PMD single-mode fiber according to Claim 8, wherein the twist is produced by said twisting system, and it can be controlled through the control of the swing angle of the twisting wheels and the proportion of time distribution among three motion forms.

10. The method of manufacturing low PMD single-mode fiber according to Claim 9, wherein the typical value of the maximum slope angle swinging by the plane in which said twisting wheels are located ranges from 5 to 20 degrees.

11. The method of manufacturing low PMD single-mode fiber according to Claim 1, wherein said fiber preform may be a solid preform or a fiber preform prepared by rod-in-tube process, the typical value of the outer diameter of said preform ranges from 40 mm to 150 mm, the typical fiber-drawing speed of said fiber-drawing tower ranges from 400 m/min to 1500 m/min, said fiber-drawing heating

furnace includes mainly graphite resistance furnace and graphite induction furnace, the typical value of fiber-drawing temperature ranges from 1730℃ to 2300℃.

12. The method of manufacturing low PMD single-mode fiber according to claim 1, wherein the typical mean value of the twist of said fiber is 25~100 turns/m; the distribution waveform of the twist of the fiber in the length direction are different forms to combine periodically constant amplitude components and constant frequency components with variable amplitude components and variable frequency components; and the typical value of the coefficient of PMD of the optical fiber is not greater than 0.03 $ps/km^{1/2}$.